

7. Circulation

29. November 2023

Problem 1.

Two trucks with the weight $m_T = 5000$ kg and the area of their side $S_T = 20$ m² are moving next to each other with the velocity $U = 90$ km/h (on the straight road, in windless conditions). Estimate the acceleration given by the difference of the external pressure and the pressure between them. Assume that the distance of the trucks d is similar to their width m and that the air "from the half of their faces" blows to the space between them (Fig. 1) in a vertically homogeneous way.

Problem 2.

Consider the curve $C(t)$ given by the particles of the fluid

$$\mathbf{x} = (a \cos s + a\alpha t \sin s, a \sin s, 0), \quad 0 \leq s < 2\pi.$$

By the direct computation, show that

$$\Gamma = \int_{C(t)} \mathbf{u} \cdot d\mathbf{x} = \int_0^{2\pi} \mathbf{u} \cdot \frac{\partial \mathbf{x}}{\partial s} ds$$

does not depend on time. Why?

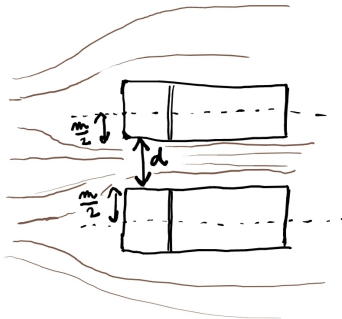


Figure 1: Truck moving next to each other.